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Signed Stephen Hordley

Dated 3 July 2003

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Request for grant of a patent
(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road
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1.	Your reference	JDM/DGR/P407379GB
2.	Patent application number *(The Patent Office will fill in this part)*	0214940.9
3.	Full name, address and postcode of the or of each applicant (*underline all surnames*)	**AWAZEL WATERPROOFING COMPANY.,** P.O.Box 2955, Riyadh, 11461, Kingdom of Saudi Arabia.
	Patents ADP number (*if you know it*)	8404659001
	If the applicant is a corporate body, give the country/state of its incorporation	KINGDOM OF SAUDIA ARABIA
4.	Title of the invention	FILTERING APPARATUS.
5.	Name of your agent (*if you have one*)	**W. P. THOMPSON & CO.**
	"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*	Coopers Building, Church Street, Liverpool L1 3AB
	Patents ADP number *(if you know it)*	0000158001

6.	If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number	Country	Priority application number *(if you know it)*	Date of filing *(Day/month/year)*
7.	If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application		Number of earlier application	Date of filing *(Day/month/year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'yes' if:*
a) any applicant named in part 3is not an inventor, or
b) there is an inventor who is not named as an applicant, or) any named applicant is a corporate body.
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YES

9. Enter then number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	6
Claims(s)	
Abstract	
Drawing(s)	1 +1

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	
Request for substantive examination *Patents Form 10/77*)	
Any other documents *(Please specify)*	

11. I/We request the grant of a patent on the basis of this application

Signature W.P. Thompson & Co. Date 27/06/2002

12. Name and daytime telephone number of person to contact in the United Kingdom: D.G. READ 0151-709-3961

Warning

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Notes

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b) Write your answers in capital letters using black ink or you may type them.
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DESCRIPTION

The present invention relates to a filtration apparatus and a method of filtration.

Many processing plants give rise to exhaust gas streams which contain liquids and solid particulate material which enter and pollute the atmosphere. Such harmful substances can fall out of suspension as the gases disperse or else condense with water droplets and fall as rain.

Stringent environmental policies in certain parts of the world encourage the use of filters or scrubbers to clean up the emissions from chimneys and other sources. These devices are inefficient, dependent upon chemical activity and require frequent maintenance to ensure that they are functioning correctly.

In accordance with a first aspect of the present invention there is provided an apparatus for filtering air said apparatus comprising a plurality of chambers which communicate with one another in series, such that air can pass from one chamber to another, each of which comprises means for generating a vortex.

This invention involves the use of a series of chambers through which the air to be cleaned e.g. an emission from an industrial plant passes without any external energy being introduced. The generation of the vortex displaces the air in a direction away from the centre of the chambers causing a pressure drop and consequently a cooling action.

The diameter of the chamber is such that it can effectively decelerate the

speed of the volume of air entering the chamber. The height of the chamber is such that there is sufficient airspace above the level of condensation in the bottom of the chamber to prevent the condensation from being drawn upwards by the outward flow of air into the next chamber.

The means for generating the vortex may comprise at least one conical plate. Mechanical means for generating a the vortex may also be used.

The deceleration of the speed of the air causes an expansion with cooling. The continuing inflow of air causes the air to be forced between the outer rim of the conical plate and the internal side wall of the chamber. This gives rise to a vortex.

Preferably, the at least one conical plate comprises a drainage channel around the outside edge, past which the condensed solids and liquids can drain. Each plate may be perforated, solid or of slatted construction, but preferably is solid.

One or more of the chambers may be sprayed externally with a cooling fluid to provide an additional cooling action.

The solids and liquid condensates which are removed from the gas stream are all recoverable from the bases of the individual chambers whence they can be recycled or collected for disposal.

More specifically, the waste gases containing the liquids and solids destined for removal are passed either by natural flow or with fan assistance from their origin into the chamber system. Preferably this process is carried out without the use of fan assistance.

The cooling fluid may be applied through spray nozzles and may or may not

be refrigerated, but preferably it is not refrigerated. The cooling fluid can drain into a reservoir whence it is recirculated over the chambers as a continuous flow.

This cooling fluid might be water, hydrocarbon solvent or liquefied gas, but preferably water.

The chambers can be constructed of mild steel, stainless steel, other metal or fibre glass or reinforced plastic, but preferably of mild steel. The steel may or not be coated internally or externally, but preferably should not be coated externally.

Unfiltered gases can be fed via pipe work of internal diameter in the range of 8 inches to 15 inches. But preferably 10 inches.

The number of chambers in the apparatus is preferably in the range of 5 to 15 more preferably 7 to 9. Preferably one or more of the first three tanks, and more preferably at least the first tank is not subject to external cooling by fluid. The remaining tanks are preferably subjected to an external spray of a fluid which will produce a cooling effect by the process of evaporation.

The height to diameter ratio of the chambers is preferably in the range of 4:1 to 6:1 more preferably 4:1, 5:1 or 6:1, and most preferably 5:1. The chambers in the apparatus may be of differing sizes or of only one size, but are preferably all of one size.

The location of the means for generating a vortex (e.g. the conical plate) within the chamber can be at the same height from the bottom in each tank or can be staggered relative to one another along a fixed gradient, such that they are linearly staggered with respect to one another.

The conical plate is preferably situated in the range of 5 cm to 35 cm from the delivery end of the inlet pipe and more preferably situated at a distance of about 25 cm. The distance between the conical plate and the delivery end of the inlet pipe forces the gas stream outwards and into the downward vortex. The gas then rises again through the centre of the chamber and when it further comes into contact with the underside of the conical plate, the gas accelerates once again around the edges of the plate to form a new upward moving vortex in the opposite direction of the incoming gas stream. This creates turbulence which in turn releases more liquid as condensate.

Condensate and solids may be collected in the base of the tank and may be removed as required through drainage cocks, pumping or other physical extraction depending on the nature of the deposit.

The exit gases from the chimney stack at the end of the process are approximately 15 °C below ambient temperature.

Where the emissions are heavily dust laden e.g. through a cold process, sufficient energy to activate the movement of the unfiltered gasses through the might require the use of a blower without the addition of heat to create sufficient air movement

The system can be used for air conditioning systems, where a simple blower would replace the need for the conventional refrigeration, thereby substantially reducing energy consumption.

The system may also be used as a filtration device for air purification e.g. in

situations where there is medical need or clean room requirement, in this case the cyclone would perform the function with just an air blower.

In accordance with a second aspect of the present invention there is provided an apparatus for filtering gas comprising one or more contaminants, said apparatus comprising a plurality of chambers which communicate with one another in series, such that gas can pass from one chamber to another, at least one of the chambers comprising an inlet port, an outlet port, an internal baffle and a receiving region below the baffle for receiving contaminants, wherein said outlet port is disposed above said baffle such that gas can pass from one chamber to another whilst contaminants are retained in the receiving region of the chamber.

The baffle may be shaped to generate a vortex. Preferably, the baffle is conical in shape.

The contaminants may be solids and/or liquids. The contaminants may be derived from an industrial process, such as waste from an oxidation tower.

The apparatus may further comprise any one or more of the above mentioned features.

In accordance with a further aspect of the present invention there is provided a method of filtering air comprising the use of an apparatus as described hereinabove.

A specific embodiment of the present invention will now be described by way of example only and with reference to the accompanying drawing:

Fig.1 is an illustration of an apparatus in accordance with the present invention.

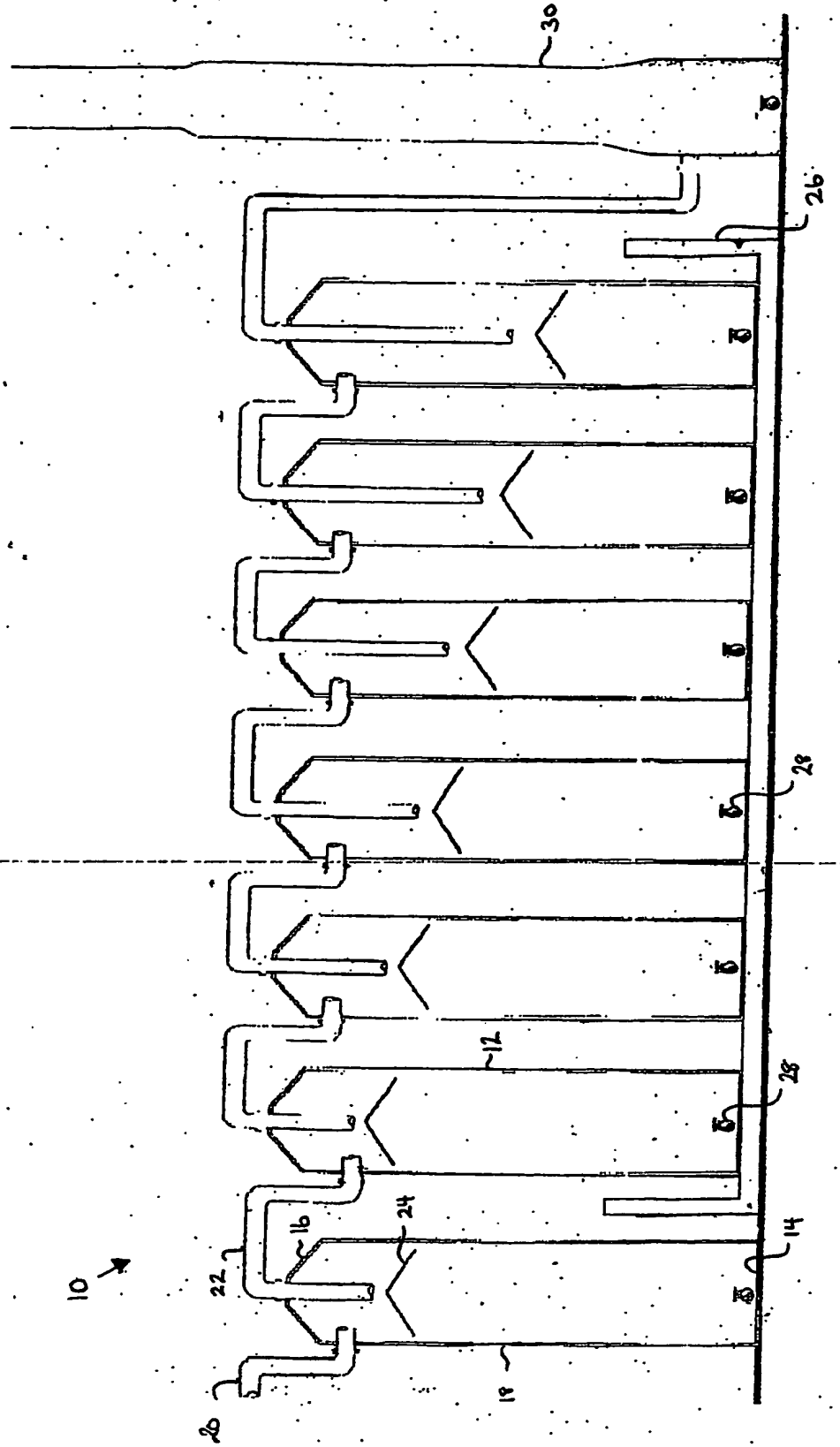
A filtration apparatus 10 consists of seven vertically disposed, elongate cylindrical chambers 12 having a planar base 14, a conical shaped top 16 and a cylindrical side wall 18. An inlet port 20 is radially disposed in side wall 18 and an outlet port 22 in conical top 16. Outlet port 22 extends into chamber 12 and terminates near to the apex of conical plate 24. Movement of the contaminated gas over the conical plate 24 creates a vortex.

The chambers 12 are disposed in series and communicate with adjacent chambers via port 22 from one chamber which becomes inlet port 20 for the next chamber. In each successive chamber the height at which conical plates 24 are disposed relative to one another is staggered along a fixed gradient, such that they are linearly staggered.

All but the first of the chambers are disposed in a tank 26. The second to seventh chambers are subjected to external spraying with a cooling fluid to facilitate condensation of gases and thereby augment filtration. The cooling fluid is applied to the external surface of the chambers by spraying nozzles (not illustrated) and is collected in the tank 26 for recirculating. Consequently, a continuous flow of cooling fluid can be maintained.

Contaminants are collected at the bottom of the chambers 12 where extraction means 28, such as a liquid drain valve, facilitate removal of retained contaminants from the chambers 12.

The outlet port of the final chamber 12 communicates with a chimney 30 which facilitates the flow of filtered gas into the atmosphere.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